

Amendment and Response

Applicant: Scott C. Willis et al.

Serial No.: 09/591,731

Filed: June 12, 2000

Docket No.: B251.104.102

Title: SYSTEM AND METHOD OF PROVIDING A SPREAD SPECTRUM PULSE WIDTH
MODULATOR CLOCK

REMARKS

This Amendment is responsive to the Office Action mailed December 24, 2003. Claims 1-3, 6-8, 10-14, 17-19, 21-24, 26-29, and 31-33 were rejected. Claims 4, 5, 9, 15-16, 20, 25, and 30 have been objected to. With this Response, claims 1, 6-12, 16-18, 20-22, 30, and 31 have been amended. Claims 1-33 remain pending in the application and are presented for reconsideration and allowance.

Claim Objections

On page 2 of the Office Action, the Examiner objected to various grammatical informalities in the claims. With this response, Applicants have corrected these informalities and respectfully request withdrawal of these objections.

Claim Rejections under 35 U.S.C. § 102 and 35 U.S.C. § 103

The Examiner rejected claims 1 and 12 under 35 U.S.C. § 102(b) as being anticipated by the Turner U.S. Patent No. 5,006,973.

The Examiner rejected claims 2-3, 13-14, and 21 under 35 U.S.C. § 103(a) as being unpatentable over the Turner patent in view of the Korcharz et al. U.S. Patent No. 6,049,471.

The Examiner rejected claims 6-7 and 17-18 under 35 U.S.C. § 103(a) as being unpatentable over the Turner patent in view of the Unitrode PWM Controller Application Notes UC1842/UC1825 ("Unitrode Application Notes").

The Examiner rejected claims 8, 10-11, 19, 22, 29, and 31-32 under 35 U.S.C. § 103(a) as being unpatentable over the Turner patent in view of the Smith U.S. Patent No. 5,309,344.

The Examiner rejected claims 23-24 and 33 under 35 U.S.C. § 103(a) as being unpatentable over the Turner patent in view of the Smith patent, and further in view of the Korcharz et al. patent.

The Examiner rejected claims 26-28 under 35 U.S.C. § 103(a) as being unpatentable over the Turner patent in view of the Smith patent, and further in view of the Unitrode Application Notes.

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Applicant submits that the Turner patent does not teach or suggest the claimed invention of independent claim 1. The Turner patent discloses a resonant, pulse width modulated power source 33 that supplies a constant amplitude, fixed-frequency current to a supply loop 31 that is inductively coupled to a plurality of pick-up loops 35. Precise, fixed-frequency control is provided by triggering a pulse width modulator (PWM) 49 with fixed-frequency sync pulses. An oscillator 47 provides the sync pulses to PWM circuit 49 that, via a switch drive circuit 53, controls the opening and closing of power switches 55. Power source 33 is designed to operate at a fixed frequency that is low enough (e.g. 38 kHz in a preferred embodiment) to avoid EMI problems with critical commercial aircraft directional and navigational equipment.

The Turner patent fails to teach an apparatus for spreading electromagnetic interference associated with an electrical system over a range of frequencies as recited in amended independent claim 1. Instead, the Turner patent discloses a power source designed to operate at fixed frequency that is low enough to merely avoid potential EMI problems at critical higher frequencies, and does nothing to reduce EMI by varying the PWM frequency in order to spread EMI over a range of frequencies.

Furthermore, the Turner patent fails to teach a plurality of resistors, wherein each of the resistors is coupled between a different one of the plurality of outputs of the binary counter and a node, wherein the node is coupled to an input of the pulse width modulator, as recited in amended independent claim 1. The Examiner asserts, in reference to Figure 8 of the Turner patent, that resistors R6 and R7 are equated to a plurality of resistors coupled to an output of a binary counter (the SYNC signal) and a node (the junction of R7, R8, C24 and C25) coupled to an input of the pulse width modulator (PWM). Resistors R6 and R7, however, are not coupled to an output of the binary counter, but are instead coupled to an emitter of a transistor Q1 which has a collector coupled to a voltage source (+V5) and a base coupled to the binary counter. Additionally, resistor R6 is not coupled to the node (the junction of R7, R8, C24 and C25), but is instead coupled to a signal ground (SG).

Additionally, the Examiner asserts that resistor R7 equates to the timing resistor coupled between the first potential (+V5) and the node. Amended independent claim 1 includes the

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limitation that the timing resistor is distinct from the plurality of resistors. As such, resistor R7 cannot also be included as part of the plurality of resistors. Consequently, resistor R6 alone cannot constitute a plurality of resistors. Furthermore, resistors R6 and R7 are coupled to the first potential (+V5) and not to the output of the binary counter (SYNC).

In view of the above, Applicant submits that the Turner patent does not teach or suggest the invention claimed by amended independent claim 1.

Amended independent claim 12 includes the limitations of a plurality of resistors, wherein each of the resistors is operatively coupled between a corresponding different one of the plurality of outputs of a binary counter and to a node, and a timing resistor operatively coupled between a first voltage potential and the node, similar to the limitations described above in regard to independent claim 1. Therefore, for the reasons cited above with respect to claim 1, the Turner patent does not teach or suggest these limitations of independent claim 12.

Therefore, Applicants request that the rejection of independent claims 1 and 12 under 35 U.S.C. § 102(b) be withdrawn, and these claims be allowed.

Furthermore, since dependent claims 2-3, and 6-8 further define patentably distinct independent claim 1; and dependent claims 13-14, 17-19, and 21 further patentably distinct independent claim 12, these dependent claims are also believed to be allowable. Therefore, Applicants respectfully request that the rejection of claims 2-3, 6-8, 13-14, 17-19, and 21 under 35 U.S.C. § 103(a) be withdrawn and these claims be allowed.

In regard to independent claim 10, the Examiner admits that the Turner patent does not teach the limitation of a pulse width modulator whose fundamental frequency is time-varying. The Examiner relies on the Smith patent to disclose this limitation of independent claim 10.

Applicants respectfully submit, however, that in addition to failing to teach a pulse width modulator whose fundamental frequency is time varying as admitted by the Examiner, the Turner patent also fails to teach an altering means coupled between the incrementing means and the resistor/capacitor network for altering the resistor-capacitor time constant based on the binary count to correspondingly time-vary the fundamental frequency of the pulse train signal of the pulse width modulator, as claimed by amended independent claim 10. Instead, the Turner patent

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discloses only a plurality of resistors and capacitors (R6, R7, R8, C23, C24, and C25) positioned between an incrementing means (CNTR1, CNTR2, and Flip-Flop Q1) and a pulse width modulator (PWM) which provide a fixed resistor-capacitor time constant to the PWM.

In regard to the Smith patent, Applicants respectfully submit that the Smith patent does not teach a pulse width modulator whose fundamental frequency is time-varying as recited in amended claim 10. Instead, the Smith patent teaches a dual active clamp converter 100 including a switch control means 180 configured to provide a zero-voltage switching condition for a primary switching means 140, wherein the primary switching means is switched at a fixed frequency. In one embodiment, the switch control means 180 comprises a pair of pulse width modulator controllers 950 and 960, with each being respectively driven by fixed frequency clock signals ϕ_1 and ϕ_2 , which are phase-shifted 180° with respect to one another.

The Examiner also asserts that the Smith patent teaches varying of the pulse width modulator frequency to improve EMI emissions. In particular, the Examiner points to specific references in the Specification of the Smith patent where converter 100 employs a switching frequency of 300 kHz (column 26, lines 14-20) and a switching frequency of 500 kHz (column 33, lines 45-55). However, these references merely describe specific embodiments of converter 100, wherein the switching frequency is fixed at 300 kHz in one embodiment and fixed at 500 kHz in another embodiment. The Examiner further points to specific references in the Abstract and the Specification (column 8, lines 33-48), that the Smith patent reduces electromagnetic interference (EMI) by time-varying the fundamental frequency of the pulse width modulator. However, the Smith patent does not teach reducing EMI in this fashion, but instead teaches reducing EMI by providing zero-voltage switching at the primary switching means 140 to substantially reduce EMI-generating current ripples resulting from non-zero voltage switching. In view of the above, Applicants submit that the Smith patent does not teach varying of the pulse width modulator frequency to improve EMI emissions as recited in amended claim 10.

In light of the above, Applicant respectfully submits that neither the Turner patent nor the Smith patent, either alone or in combination, teach or suggest the claimed invention of amended independent claim 10.

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Amended independent claim 31 includes the limitations of a pulse width modulator whose fundamental frequency is time-varying and of altering a resistor/capacitor time constant based on a binary count, similar to those described above with respect to independent claim 10. Therefore, for the reasons cited above with respect to independent claim 10, neither the Turner patent nor the Smith patent, either alone or in combination, teach or suggest the claimed invention of amended independent claim 31.

Therefore, Applicants request that the rejection of independent claims 10 and 31 under 35 U.S.C. § 103(a) be withdrawn and that these claims be allowed.

Furthermore, since dependent claim 11 further defines patentably distinct independent claim 10; and dependent claims 32-33 further define patentably distinct independent claim 31, these dependent claims are also believed to be allowable. Therefore, Applicants respectfully request that the rejection of claims 11 and 32-33 under 35 U.S.C. § 103(a) be withdrawn and that these claims be allowed.

In regard to independent claim 22, the Examiner admits that the Turner patent does not teach the limitations of a power switch for receiving an input power, and a filter operatively coupled to the power switch. The Examiner relies on the Smith patent to disclose these limitations of independent claim 22.

Amended independent claim 22, however, further includes the limitations of a plurality of resistors, wherein each of the resistors is operatively coupled between a corresponding different one of the outputs of a binary counter and a node, and a timing resistor operatively coupled between a first voltage potential and the node, similar to those described above in regard to independent claim 1. Therefore, the Turner patent also fails to teach these limitations for the reasons cited above with respect to independent claim 1.

In light of the above, Applicants respectfully submit that neither the Turner patent nor the Smith patent, either alone or in combination, teach or suggest the claimed invention of amended independent claim 22. Accordingly, Applicants request that the rejection of independent claim 22 under 35 U.S.C. § 103(a) be withdrawn and that claim 22 be allowed.

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Furthermore, since dependent claims 23-24 and 26-29 further define patentably distinct independent claim 22, these dependent claims are also believed to be allowable. Therefore, Applicants respectfully request that the rejection of claims 23-24 and 26-29 under 35 U.S.C. § 103(a) be withdrawn and that these claims be allowed.

Allowable Subject Matter

The Examiner objected to claims 4-5, 9, 15-16, 25, and 30 for being dependent upon a rejected base claim, but as being allowable if rewritten in independent form including all limitations of the base claim and any intervening claims.

Applicants agree with the Examiner that claims 4-5, 9, 15-16, 25, and 30 would be allowable if rewritten in independent form. Nevertheless, in view of the above, Applicants respectfully submit that independent claims 1, 12, and 22 are not taught or suggested by the cited references. Therefore, as dependent claims 4, 5, and 9 further define patentably distinct independent claim 1, as dependent claims 15, 16, and 25 further define patentably distinct independent claim 12, and as independent claim 30 further defines independent claim 22, these dependent claims are believed to be allowable in dependent form. Therefore, Applicants respectfully request that objections to dependent claims 4-5, 9, 15-16, 25, and 30 be removed and that these claims be allowable in dependent form.

CONCLUSION

In view of the above, Applicants respectfully submit that pending claims 1-33 are in form for allowance and are not taught or suggested by the cited references. Therefore, reconsideration and withdrawal of the rejections and allowance of claims 1-33 is respectfully requested.

No fees are required under 37 C.F.R. 1.16(b)(c). However, if such fees are required, the Patent Office is hereby authorized to charge Deposit Account No. 19-0130.